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BRUSHWELLMAN
ENGINEERED MATERIALS

Brush Wellman Inc.
P.O. Box 815
Delta, Utah 84624
Phone 801/864-2701

April 16, 1998

Mr. Larry Mize
Utah Division of Water Quality
288 North 1460 West
Salt Lake City, Utah 84114-4870

RE: Implementation of Ground Water Quality Impact Assessment Plan for Topaz Beryllium Mine
Dear Mr. Mize:

As you are aware, Brush Wellman, Inc. (BWI) submitted a Draft of the subject plan on December 30, 1996 and received the Division's comments on the draft plan in a letter dated February 13, 1997. In response to that letter BWI incorporated the Division's comments and submitted a modified plan to the Division on May 23, 1997. In the transmittal letter accompanying that plan we stated our belief that the materials called for to be tested in the plan would be exposed by pre-stripping and mining activities later that summer; however, exposure of ore and the entire waste rock section in the pit was delayed. The materials to be sampled have now been or will soon be exposed; therefore, BWI intends to begin materials sampling for laboratory testing and analysis soon. We plan to complete sampling by May 30 and finish the assessment plan report by July 30.

During recent telephone conversations with Mr. Tom Munson of the Division of Oil Gas and Mining (DOGM), Mr. Munson has expressed his surprise over the Division's opinion that the materials sampling program is necessary. Mr. Munson brought up the same issues regarding the absence of sulfide mineralization that we had discussed with you in June 1996 and later presented in our July 1, 1996 letter. We understand that Mr. Munson has also expressed this opinion during discussions with you.

The geologic literature, clearly demonstrates that the rock types and the mineralizing system at the Topaz Beryllium mine are not the type with which sulfide mineralization is found. *No* sulfide minerals have been identified by BWI geologists in ore or waste rock. Geology and mineralization in the Topaz Mountain-area beryllium deposits have been described in publications by the United States Geological Survey and the United States Bureau of Mines. Copies of these papers were provided Mr. Mac Croft, formerly with the Division, in June 1996. These publications describe the host rocks and overlying and underlying bedrock deposits as non-sulfide-bearing. Further, they describe the various mineral suites that resulted from mineralization and hydrothermal alteration of the host rocks. Not only are no sulfide minerals described, but the lithologies and mineral suites

described are characteristic of rock types and mineral deposits that have been recognized by geologists for nearly a century as not having associated sulfide minerals.

BWI requests that for the reasons presented above the Division concur that sampling and analysis of waste rock and ore for acid generation and neutralization potential be eliminated from the assessment plan. A revised version of the Ground Water Impact Assessment Plan reflecting elimination of acid-generation and neutralization potential testing is submitted herewith. If you concur with our recommended changes to this plan, we request that your approval notification be sent by mail and fax no later than May 11, 1998 so that we can schedule the sampling and laboratory testing as soon as possible thereafter.

Should you have any questions regarding this matter, please contact the undersigned as soon as possible.

Sincerely,

Greg Hawkins RJS

Greg Hawkins
Mine Manager

Attachment

cc: Dennis Frederick, DWQ
Tom Munson, DOGM
Bob Bayer, JBR Environmental
Don McMillan, BWI
John Wagner, BWI

M/023/003

GROUND WATER QUALITY IMPACT ASSESSMENT PLAN
BRUSH WELLMAN, INC., TOPAZ BERYLLIUM MINE

Introduction

In a letter dated July 23, 1996 from Mr. Greg Hawkins of Brush Wellman, Inc. to Mr. Larry Mize of the Division of Water Quality, Brush Wellman asserted that the Topaz Beryllium mine is exempt from the Utah Ground Water Protection Regulations because the mine will not "...result in a discharge of pollutants that may move directly or indirectly into groundwater...." The letter then stated Brush Wellman's intention to support this assertion by preparing a plan for assessment of the potential impact to ground water quality by the open pits, stockpiled ore, and waste rock dumps at the mine. This document presents that plan.

Proposed Sampling Plan

Brush Wellman's extensive experience mining beryllium ores at the Topaz Beryllium mine has resulted in a thorough understanding of the distribution of beryllium in the ore deposits. The mining sequence for the deposits at the mine is selected so that both a low-grade and high grade deposit are developed and mined simultaneously. The ores from these deposits are then blended in separate stockpiles resulting in a low grade and a high grade stockpile. Ore from each stockpile is shipped to the mill in proportions corresponding to the beryllium concentration in each stockpile so that the beryllium concentration of the ore shipped to the Delta Mill meets the requirements established by the mill.

In addition to beryllium, trace elements (primarily metals), which represent potential ground water contaminants, are present in the ore and waste rock. The concentrations of these elements are variable in the deposits and may in part increase and decrease in correspondence with beryllium concentrations. Therefore, representative high grade and low grade open pits, the waste rock dumps derived from them, and the active high grade and low grade ore stockpiles are proposed for sampling as part of this investigation.

Two high grade open pits, Monitor #3 and Roadside/Fluro #3 and the waste rock dumps derived from mining them have been selected for sampling. Likewise, two low grade open pits, North Blue Chalk #2 and Section 16 #1 and their waste rock dumps are also proposed for sampling. The following types of waste rock samples are proposed to be taken from each pit or dump: unaltered rhyolite, altered rhyolite, and waste tuff (from either above or below the ore zone). By sampling four separate pit/dumps, four samples of each waste rock type will be obtained. Samples will be collected randomly from either dumps or pit walls using a backhoe or a drill rig. Each sample will consist of a composite sample made up of at least three components.

The ore bodies at the topaz Beryllium mine are highly oxidized; therefore, selection of waste rock samples from either pit walls or waste rock dumps will be equally representative of waste rock and pit wall rocks in terms of overall rock chemistry. The locations of sampling points will be determined by Brush Wellman after taking into consideration accessibility to representative rock types and safety.

The active low grade ore stockpile, derived from and located adjacent to the Section 16#1 pit and the active high grade ore stockpile, derived from and located adjacent to the Roadside/Fluro #3 pit, will be also be sampled. Brush Wellman blends the ore in the stockpiles so the mill feed concentrations are relatively constant; therefore, the stockpiles can be considered homogeneous. Two representative three-component composite samples of the ore will be gathered from each stockpile, resulting in a total of four ore samples.

The size of each sample component will be approximately 15 pounds. The components of each sample will be placed into a single plastic bucket with a five to six gallon capacity resulting in a composite sample weighing approximately 45 pounds. The sample containers will be sealed and sent under chain of custody to SVL Analytical for thorough blending, sample preparation (crushing and aliquot separation), and analysis. An extra sample of each waste rock type (three samples) and one extra ore sample will be also collected and sent to the lab. These samples will be used in pre-testing the material for percolation to determine the extraction protocol to be used, as discussed below.

Proposed Sample Analysis Plan

The proposed plan for assessment of the potential for impact to ground water quality by Brush Wellman Inc.'s mining operations consists of assessment of the potential for leaching of contaminants from ore stockpiles, waste rock dumps, and open pit wall rocks. Since the rock

types, mineralization and hydrothermal alteration at the mine have been demonstrated in both the geologic literature and in the experience of Brush Wellman geologists to contain no sulfide minerals, acid conditions will not result from oxidations of ore or waste materials that are brought to the surface or exposed during mining. Therefore, the method of analysis proposed will be direct testing of samples for leachable elements using the meteoric water mobility procedure (MWMP) which was developed by the State of Nevada and is now being considered by the American Society for Testing Materials (ASTM) for adoption as a standard testing method for leachability of metals and other elements from ores and waste rock. This procedure has been selected because it best simulates field conditions believed to exist at Brush Wellman: leaching by rain water that results in a non-acid leachate.

The MWMP procedure calls for a single-pass column leach over a 24-hour period using a Type II reagent grade water (deionized water, etc). Five kilograms of the sample are prepared by crushing it to minus 2 inches. The sample is then placed in a six-inch diameter PVC column. Extraction fluid in a ratio of 1:1 by volume is applied to the column. Extraction fluid is applied in the following manner: "...the extraction fluid application rate [is adjusted] such that the number of milliliters of water applied to the column in a 24 hour period will be equal to the number of dry grams of mine rock sample in the column." Extraction is complete when the prescribed volume has passed through the column and has been collected. This extract is then filtered, appropriately preserved, and analyzed for the appropriate parameters. A complete description of the MWMP is provided in the Appendix.

If fine-grained samples prevent percolation of the necessary water volume in a 24-hour period, an alternate extraction procedure is used. The extra sample collected for each of the three waste rock types and of ore will be used in a preliminary test of column percolation. If this percolation test demonstrates that the procedure cannot be completed in a 24-hour period, the alternate extraction procedure to be used will be a modified bottled roll. This method calls for five kilograms of sample and five liters of Type II reagent grade water to be placed in vessel which is then rotated for a 24-hour period. The extract is then removed from the vessel and filtered prior to preservation and analysis.

Brush Wellman proposes that the extract samples from each of the rock samples be analyzed for fluoride, the metals and radionuclides for which Utah ground water quality standards have been established, as well as beryllium. The Division has requested that the extract also be analyzed for antimony and thallium. Although these metals are not associated with ore deposits of this type, Brush Wellman agrees to analyze the extract for these metals. Uranium has also been

added to the list of analytes for the MWMP extract solutions at the Division's request. Table 1 lists these parameters.

Table 1. Proposed Analytical Parameters for Leachate Extract Analysis	
Antimony	Mercury
Arsenic	Selenium
Barium	Silver
Beryllium	Thallium
Cadmium	Uranium
Chromium	Zinc
Copper	Gross alpha particle activity
Lead	Combined Radium-226 and Radium-228

The radionuclide analyses are proposed to be conducted sequentially. We propose that the radium analyses be performed on the extract for a given sample only if the gross alpha analysis for that sample exceeds the ground water quality standard for radium of 5 pCi/l. Since radium is an alpha emitter, it is unlikely that the radium standard will be exceeded if the gross alpha activity is less than the standard for radium. All sample extracts would be analyzed for uranium.

Brush Wellman proposes that the Utah ground water quality standards for the elements listed above be considered thresholds for evaluation of the results of the MWMP. If the standards are not exceeded in the MWMP extract, no further investigation would be warranted. Brush Wellman believes that the Topaz Beryllium mine should then be considered exempt from the ground water regulations since it will have been demonstrated that the mine activities will not "... result in discharge of pollutants that may move directly or indirectly into ground water." If one or more of the standards are exceeded, Brush Wellman proposes to conduct additional testing and evaluation. The plan for such testing and evaluation would be developed using the initial test results for guidance in selecting any necessary additional sampling, supplemental laboratory analysis, or other means of evaluating potential ground water impact, including consideration of the site-specific geology, hydrogeology and geochemical evaluations.

Brush Wellman believes that the sampling and analytical plan described in the foregoing sections will provide a thorough and representative assessment of the potential for leaching of trace elements from ore and waste rock.